

C-O-N-F-I-D-E-N-T-I-A-L

Approved For Release 2001/08/27 : CIA-RDP79-00798A000400100002-1

*[Signature]*  
8 Apr 74  
(DATE)

MEMORANDUM FOR THE RECORD

SUBJECT: Opinion Request - *Microbial Control of Agr Pests*

Attached is self-explanatory material from the Department of State.  
May we have your opinion by ASAP.

Please state degree of interest and whether we will receive requirements.

(IMAGE)

COMMENTS:

25X1A DISTRIBUTION:



-051

*info to  
O&R defer 051  
Ellie  
SP  
Hme  
L&S*

*over taken by  
"briefing"  
packets"  
AB*

*Microbial Control of Agr Pests*

E2 IMPDET  
CL BY: 007622

State Dept. declassification & release instructions on file

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*microbial control of agr. pests. It*  
NATIONAL SCIENCE FOUNDATION

*Printed*  
→ EUR/SES - Mr. Perdon  
FY11

STATINTL

WASHINGTON, D.C. 20550

*you have any comment they would be  
needed by Apr. 12.*

March 25, 1974

*Ray*

Dr. Martin D. Alexander  
Department of Agronomy  
Cornell University  
Ithaca, New York 14850

Dear Dr. Alexander:

Enclosed are copies of the Working Group's Working Plans, Plan of Action, Milestone Charts, and Budgets. (The Budgets do need clarification.) When we meet at the Foundation on Tuesday, April 16 (9:00 a.m. in room 338), we plan to discuss this material and the Russian Working Plans, which we hope to receive before that time. (Only our Working Plans were sent to the USSR Working Group.

All members should be prepared to arrive at definite U. S. positions, and be prepared to determine what our negotiating stance should be for the Joint Meeting of the US/USSR Working Group that we expect will be held in Washington on June 10-12 (first choice), May 6-8 (second choice), or June 24-26 (third choice). We hope to hear from the Russian side soon.

You will be contacted concerning your travel and hotel plans, and it would facilitate matters if you would let me know as soon as possible, if you cannot attend the April 16 meeting.

The signature block below is changed because Art Humphrey decided, that since extensive early planning of the Working Group has been completed, and because of a possible conflict of interest (as Chairman he would be recommending grants to himself), he should not continue to serve as Chairman. Art suggested, and Dr. Stever agreed, that he be made Co-Chairman and that I serve as Chairman. Art will still serve as Coordinator for Instrumentation and Modelling.

Sincerely yours,

J. M. Leise  
Chairman  
U.S. Working Group on the  
Production of Substances by  
Microbial Means

Enclosures

Identical Letters sent to the following:  
Approved For Release 2001/08/27 : CIA-RDP79-00798A000400100002-1

Dr. Henry Bungay  
Vice President for Research & Development  
The Worthington Chemical Company  
Freehold, New Jersey 07728

Dr. Edmund Field  
Consultant  
American Oil Company  
5719 South Kenwood Avenue  
Chicago, Illinois 60637

Dr. Harlyn O. Halvorson  
Professor of Molecular Biology  
Brandeis University  
Waltham, Massachusetts 02154

Dr. William E. Brown  
Director, Department of Microbiology  
The Squibb Institute of Medical Research  
Princeton, New Jersey 08540

Dr. George Tsao  
Program Director  
Division of Advanced Technology  
Applications  
National Science Foundation  
Washington, D. C. 20550

Dr. Daniel I. C. Wang  
Department of Nutrition & Food Science  
Massachusetts Institute of Technology  
Cambridge, Massachusetts 02139

Dr. Charles Cooney  
Department of Nutrition & Food Science  
Massachusetts Institute of Technology  
Cambridge, Massachusetts 02139

Copies of these letters went to:

Dr. Ganley )  
Dr. Wald ) State Department

Dr. Thomas, OIP

Dr. Arthur M. Heimpel  
Plant Protection Institute  
Bio-Science Bldg., Room 210  
U.S. Department of Agric.  
Beltsville, Md. 20704

MICROBIAL CONTROL OF PEST OF AGRICULTURAL CROPS

Purpose

The development of technology to mass produce the Nuclear Polyhedrosis Viruses (NPV) and Granulosis Viruses (GV) in insect cell culture. The insect viruses are among the safest and most effective microbial control agents to control lepidopterous pests of food and fiber crops. Insect viruses can be produced economically only in living insects. The culture of insect cells in artificial media promises a more controlled and better source for producing these viruses.

Problems to be Studied

1. The establishment of lines of cell cultures from insect pests.
2. The development of media to support insect cell cultures and the modification of media to insure maximum virus production.
3. The development of technology to mass produce insect cell lines.
4. The development of techniques to mass-store insect cells.

Forms of Cooperation

Development and carrying out of the joint research programs.

Exchange of information of the research results.

Exchange of the research personnel involved in joint research programs during the research period.

Planning of symposia and conferences.

Comparisons and discussion of the research results, including publication.

U.S.A.: The National Science Foundation

U.S.S.R.: The Main Board for Microbiological Industry  
Council of Ministers of the U.S.S.R.

Program Coordinators

U.S.A. The program coordinators will be appointed one month following the approval of the Record by the Joint Commission.

U.S.S.R. The program coordinators will be appointed one month following the approval of the Record by the Joint Commission.

Suggested Participating Organizations

U.S.S.R.: All-Union Research Institute of Microbiological Means for Plant Protection and Bacterial Preparations; Institute of Microbiology of the Armenian Academy of Sciences; All-Union Institute of Plant Protection of the All-Union Academy of Agricultural Sciences.

U.S.: U. S. academic institutions and research centers will be named one month following approval of this Record by the Joint Commission.

The Program of Cooperation

- 1.1 Collect through surveys and from collaborators strains of milky disease bacteria.
- 1.2 Selection of virulent strains of B. popilliae and other similar bacteria.
- 1.3 Investigate sporulation of B. popilliae, develop appropriate media etc.
- 1.4 Develop technology to scale up fermentation and sporulation to at least pilot plant level.

Expected results:

1. The research described above is expected to lead to the ability to produce sufficient milky disease spores to carry out large scale permanent suppression of scarabaeid pests.
2. The acquisition of the most virulent bacterial pathogen for each insect pest considered.
3. An understanding of the process of multiplication and sporulation by these fastidious bacteria.

4. Development of technology to produce large quantities of milky disease spores.

Immediate Steps

1. Development of a joint research program.
2. Exchange of information and scientists.

## MICROBIAL CONTROL OF PESTS OF AGRICULTURAL CROPS

### Purpose

Bacterial sporeformers resembling the milky disease organism of the Japanese beetle have been isolated from Scarabaeid larvae (white grubs) on most continents. These bacteria make highly effective, and permanent insect control agents. To date they can only be produced in living insects. Attempts to bring about sporulation in artificial media would make widespread control of white grubs feasible.

### Problems to be Studied

1. Establishment of mutual collections of Bacillus popilliae strains and other milky disease bacteria resembling B. popilliae.
2. Develop and conduct surveys for virulent strains of B. popilliae and assays for these strains.
3. Investigate basic principles necessary to sporulate B. popilliae in artificial media.
4. Develop technology to scale up the fermentation and sporulation of B. popilliae on a commercial scale.

### Forms of Cooperation

Development and carrying out of the joint research programs.

Exchange of information of the research results.

Exchange of the research personnel involved in joint research programs during the research period.

Exchange of bacterial cultures.

Planning of symposia and conferences.

Comparisons and discussion of the research results, including publication.

Page 2

Responsible Organizations

U.S.A.: The National Science Foundation

U.S.S.R.: The Main Board for Microbiological Industry  
Council of Ministers of the U.S.S.R.

Program Coordinators

U.S.A. The program coordinators will be appointed one month following the approval of the Record by the Joint Commission.

U.S.S.R. The program coordinators will be appointed one month following the approval of the Record by the Joint Commission.

Suggested Participating Organizations

U.S.S.R. Microbiology and Virology Institute, U.S.S.R., Academy of Science Kiev; Institute of Microbiology of the Armenian Academy of Sciences; All-Union Institute of Plant Protection of the All-Union Academy of Agriculture Sciences.

U. S. U. S. academic institutions and research centers will be named one month following approval of this Record by the Joint Commission.

The Program of Cooperation

1. The development and exchange of cell lines from lepidopterous pests.
  - 1.1 The investigation of cell requirements, a) for good insect cell growth, b) for good virus production. Determine the least expensive effective media.
  - 1.2 The development of modified equipment to grow insect cells in maximum number per unit volume of media.
  - 1.3 Investigation of cell storage technology.

Expected results:

1. The acquisition of cell lines. Selected or adopted to the purpose of mass producing virus.
2. An intimate and better knowledge of insect cell requirements which should permit the devising of an economical, mass-culture media.
3. The development of equipment suitable for insect cell production and mass virus production.



4. The technique of freezing and storage of insect cell inocula for mass cell production.

Immediate Steps

1. Development of a joint research program.
2. Exchange of information and scientists.

**CONFIDENTIAL**

USAF POSITION ON COMMUNIST BLOC VISITORS

Visitors: Microbiology Bilateral

Project and Sponsor:

LGZ	AFSC	FTD	<del>Other AFSC</del>
	N/O	N/O	1

8. USAF also provides the following:

Opinion # 27-3 Due 23 Apr 74

Passed to IIAGE 24 Apr 74

Classified by CIA/IIAGE  
 EXEMPT FROM GENERAL DECLASSIFICATION  
 SCHEDULE OF EXECUTIVE ORDER 11652  
 EXEMPTION CATEGORY 2  
 DECLASSIFY ON Indy

**CONFIDENTIAL**

23 Sept 1976

all carded.  
Don  
Cory

WORKING PROGRAM and Utilization of Food and Feed Proteins by Microbial Means, Including Research into Different Aspects of Toxicity

PROJECT NO. 1

PROJECT TITLE and Biological Value of Such Products

PROJECT COORDINATOR Dr. Gregorian, U.S.S.R. and Dr. Daniel I.C. Wang, M.I.T., U.S.A

TASK NUMBER		NAME OF TASK OR SUB-TASK	NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS U.S.S.R. U.S.	DATE AND DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
2A		ARRANGE WORK-SHOP MEETINGS ON SINGLE-CELL PROTEIN RESEARCH (PART A)	Gregorian D.I.C. Wang M.I.T.	July, 1974 and continuing	Exchange of Publications and Conference Reports	Establish and Continue Basis of Communication
		TOTAL: 20 U.S. PART. AND 6 U.S.S.R. PART				
		DURATION: 3 DAYS				
2.1	Biological Value and Toxicity	V. Young, M.I.T. N. Scrimshaw, M.I.T. B. Oser, F & D Res. Lab. D. Calloway, U. Cal	Fall, 1974	Meet in U.S.A.	Planning, Initiation and Reporting on Cooperative Program	
2.2	Selection of Microbe-Substrate Systems	D.I.C. Wang, M.I.T. C.L. Cooney, M.I.T. C. Dunlap, U. Missouri A. Laskin, Esso C. Wilke, U. Calif. J. Litchfield, Battelle E. Field, Std. Ind. A. Humphrey, U. of Pa. G. Tsao, N.S.F.	Fall, 1974	Meet in U.S.A.		
2.3	Single-Cell Protein For Food	S.R. Tannenbaum, M.I.T. C.C. McDonald, DuPont C. Atkins, Std. Ind. C. Rha, M.I.T. M. Milner, UN (PAG) T. Labuza, Univ. Minn.	Fall, 1974	Meet in U.S.A.		
2.4	Methods of Decreasing Nucleic Acid Content	A.J. Sinskey, M.I.T. S.R. Tannenbaum, M.I.T.	Fall, 1974	Meet in U.S.A.		

Microbiology - file

WORKING PROGRAM Development of Technology for Industrial Production and Utilization of Food and Feed Proteins by Microbial

PROJECT NO. 1

PROJECT TITLE Means, Including Research into Different Aspects of

Toxicity and Biological Value of Such Products

PROJECT COORDINATOR Dr. Gregorian, U.S.S.R. and Dr. Daniel I.C. Wang, M.I.T., U.S.A.

TASK  
NUMBER

NAME OF  
TASK OR  
SUB-TASK

NAME OF PARTICIPANTS  
AND COOPERATING INSTITUTIONS  
U.S.S.R. U.S.

DATE AND  
DURATION OF  
TASK

FORMS OF  
COOPERATION

EXPECTED  
RESULTS

2B

ARRANGE WORK-SHOP MEETINGS ON SINGLE-CELL PROTEIN RESEARCH (PART 2)

TOTAL: 20 U.S.S.R. PART & 6 U.S. PART

DURATION: 3 DAYS

2.1 Biological Value  
and Toxicity

N.S. Scrimshaw, M.I.T.

Fall, 1975

Meet in U.S.S.R.

Planning, Implementing, and Reporting on Cooperative Program

2.2 Selection of Microbe-  
Substrate Systems

D.I.C. Wang, M.I.T.  
E. Field, Std. Ind.

Fall, 1975

Meet in U.S.S.R.

2.3 Single-Cell Protein  
for Food

C. Rha, M.I.T.  
M. Milner, UN (PAG)

Fall, 1975

Meet in U.S.S.R.

2.4 Methods for Decreasing  
Nucleic Acid Content

S.R. Tannenbaum, M.I.T.

Fall, 1975

Meet in U.S.S.R.

"

"

"

PROJECT NO. 1

WORKING PROGRAM Development of technology for industrial production and utilization of food and feed proteins by Microbial Means, Including Research into Different Aspects of Toxicity and Biological Value of Such Products

PROJECT COORDINATOR Dr. Gregorian and Dr. Wang

TASK NUMBER

NAME OF TASK OR SUB-TASK

NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS

U.S.S.R.

U.S.

DATE AND DURATION OF TASK

FORMS OF COOPERATION

EXPECTED RESULTS

## WORKING PROGRAM OF SIX PROBLEM TOPICS

## CHOICE AND SELECTION OF MICROORGANISMS

3.1 Selection of Bacterial and Yeast Culture

R. Donovick, ATCC  
NRRL Cult. Coll.  
G. Silverman, U.S.  
Natick  
M.I.T.  
Univ. of Wis.  
L.S.U.

Fall, 1974 and Continuing

Microbial Culture Exchange  
Establish and Broaden Existing Cultures

3.2 Regulation and Control Amino Acid Content of SCP

A.L. Demain, M.I.T.  
S.R. Tannenbaum, M.I.T.

Fall, 1974 1 Day and Continuing

Meet in U.S.A. Review Past Progress  
Exchange of Existing Research Results  
Exchange of Existing Techniques

## RAW MATERIAL AND ECONOMIC ANALYSIS OF SCP PRODUCTION

4.1 Cultivation of Yeast on Molasses, Ethanol, Methanol, Hydrocarbons, With Techno-Economic Analysis

D.I.C. Wang, M.I.T.  
(Hydrocarbons)  
C.L. Cooney, M.I.T.  
(Methanol)  
A.E. Humphrey U. of Pa.  
(Molasses)

Two Years  
(1974-1976)  
Two Years  
(1974-1976)  
Two Years (1974-76)  
(U. of Pa.)

Exchange of Reports  
Forecast and Specify Economically feasible substrates for SCP Production

4.2 Cultivation of Bacteria on Methanol, Ethanol, Agricultural

C. Dunlap, U. Missouri  
(Cellulose)

Two Years  
(1974-1976)  
U. of Missouri

Exchange of Reports

"

4.3 Comparison of Basic Variables &amp; Choice of Substrate

M.I.T.  
U. of Pa.  
U. Missouri

One Week Fall, 1975

Conference to Discuss Progress, Analysis of Results From 4.1 & 4.2 at M.I.T.  
USA- 5 USA Part.  
5 USSR Part.

PROJECT NO. 1

WORKING PROGRAM Development of Technology for Industrial Production and Utilization of Food and Feed Proteins by Microbial Means, Including Research into Different Aspects of PROJECT TITLE Toxicity and Biological Value of Such Products

PROJECT COORDINATOR Dr. Gregorian and Dr. Wang, M.I.T.

TASK NUMBER	NAME OF TASK OR SUB-TASK	NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS	DATE AND DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
DEVELOPMENT OF METHODS FOR PROTEIN ISOLATION FROM UNICELLULAR MICROORGANISMS					
5.1	Development of Enzymatic & Mechanical Methods of Protein Release	D.I.C. Wang, M.I.T. (Release)	Two Years (1974-1976)	Exchange of Research Report	Information Exchange to Establish Technical and Economic Feasibilities
5.2	Development of Techniques For Reduction of Nucleic Acids By Enzymatic & Physico-Chemical Means	A.J. Sinskey, M.I.T. S.R. Tannenbaum, M.I.T.	Two Years (1974-1976)	Exchange of Research	Information Exchange and Establish Technical and Economic Feasibilities
DEVELOPMENT OF INDUSTRIAL METHODS OF BIOMASS PRODUCTION					
6.1	Fermentor Apparatus Design & Scale-up	D.I.C. Wang, M.I.T.	Two Years (1974-1976)	Exchange of Reports	Establish Report on Fermentor Design Most Optimal for SCP Cultivation
6.2	Biomass Recovery	D.I.C. Wang, M.I.T.	Two Years (1974-1976)	Exchange of Reports	Define Process Parameters for Most Economical Means of Biomass Recovery
6.3	Purifying & Drying	T. Labuza, U. Minn.	Two Years (1974-1976)	Exchange of Reports	Establish & Process
6.4	Elaboration on Increased Capacity (Scale-up) For Biomass Purification and Production; Overall Process Evaluation; Economic Analysis	D.I.C. Wang, M.I.T. T. Labuza, U. Minn.	2 Months Fall, 1977	Work-shop with Specific Processes 5 US Part.; 5 USSR Part. Meet in USSR	Establish Techno-Economic Basis for Scale-up of Biomass Purification & Production

PROJECT NO. 1

WORKING PROGRAM  
Development of technology for utilization of food and feed proteins by Microbial Means Including Research into Different Aspects of Toxicity  
PROJECT TITLE  
And Biological Value of Such Products

PROJECT COORDINATOR Dr. Gregorian, U.S.S.R. and Dr. Daniel I.C. Wang, M.I.T.

TASK NUMBER	NAME OF TASK OR SUB-TASK	NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS	DATE AND DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
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SPECIAL TREATMENT OF BIOMASS AND ISOLATED PROTEIN THEREFROM FOR USE IN PREPARATION OF FOODS

7.1	Protein Isolation, Characterization of SCP	C. Rha, M.I.T.	Two Years (1975-1977)	Exchange of Research Reports	Definition of Protein Isolation & Characterization of Isolated SCP
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7.2	Protein Utilization in Preparation of Foods	T. Labuza, U. Minn.	Two Years (1975-1977)	Exchange of Research Reports	Establish Protocol & Potential Uses of Prepared Foods From SCP
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BIOLOGICAL VALUE AND TOXICITY

A.A. Pokrovsky , Nutrition Institute	N.S. Scrimshaw, M.I.T.	Three Years (1974-1977)	Exchange of Reports	Establish Safety of SCP
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## FIRST PRIORITY

## BUDGET TIMING OVER FIVE YEARS

## Project No. 1

Task No.	1st Year	2nd Year	3rd Year	4th Year	5th Year	Subtotal for 5 Years
1	\$500	0	0	0	0	\$500
2A	\$5000	0	0	0	0	\$5000
2B	0	0	0	0	0	0
3.2	1000	-	-	-	-	\$1000
4.1	25,000	25,000	-	-	-	50,000
4.2	25,000	25,000	-	-	-	50,000
5.1	20,000	10,000	-	-	-	30,000
5.2	20,000	10,000	-	-	-	30,000
6.1	30,000	20,000	-	-	-	50,000
6.2	-	-	-	-	-	0
6.3	-	-	-	-	-	0
6.4	-	-	-	-	-	0
7.1	-	-	-	-	-	0
7.2	-	-	-	-	-	0
8	20,000	20,000	-	-	-	40,000
Total	\$146,500	\$110,000	0	0	0	\$256,500

## BUDGET TIMING OVER FIVE YEARS

Project No. 1

## SECOND PRIORITY

Task No.	1st Year	2nd Year	3rd Year	4th Year	5th Year	Subtotal for 5 Years
1	\$1000	\$500	\$500	-	-	\$2000
2A	\$9000	-	-	-	-	\$9000
2B	-	\$9000	-	-	-	\$9000
3.2	\$1000	-	-	-	-	\$1000
4.1	\$55,000	\$55,000	-	-	-	\$110,000
4.2	\$55,000	\$55,000	-	-	-	\$110,000
4.3	-	\$2000	-	-	-	\$2000
5.1	\$35,000	\$45,000	-	-	-	\$80,000
5.2	\$30,000	\$50,000	-	-	-	\$80,000
6.1	\$45,000	\$55,000	-	-	-	\$100,000
6.2	\$40,000	\$40,000	-	-	-	\$80,000
6.3	\$45,000	\$55,000	-	-	-	\$100,000
6.4	-	-	\$20,000	-	-	\$20,000
7.1	-	\$40,000	\$40,000	-	-	\$80,000
7.2	-	\$40,000	\$40,000	-	-	\$80,000
8	\$50,000	\$50,000	\$50,000	-	-	\$150,000
Total	\$366,000	\$496,500	\$155,500	-	-	\$1,013,000

## BUDGET TIMING OVER FIVE YEARS

Project No. 1

## THIRD PRIORITY

Task No.	1st Year	2nd Year	3rd Year	4th Year	5th Year	Subtotal for 5 Years
1	\$1000	\$500	\$500	-	-	\$2000
2A	\$9000	-	-	-	-	\$9000
2B	-	\$9000	-	-	-	\$9000
3.2	\$1000	-	-	-	-	\$1000
4.1	\$100,000	\$100,000	\$50,000	-	-	\$250,000
4.2	\$100,000	\$100,000	\$50,000	-	-	\$250,000
4.3	-	\$2000	-	-	-	\$2000
5.1	\$60,000	\$70,000	\$30,000	-	-	\$160,000
5.2	\$40,000	\$50,000	\$30,000	-	-	\$120,000
6.1	\$50,000	\$60,000	\$150,000	-	-	\$250,000
6.2	\$40,000	\$50,000	\$10,000	-	-	\$100,000
6.3	\$80,000	\$80,000	\$40,000	-	-	\$200,000
6.4	-	-	\$35,000	-	-	\$35,000
7.1	-	\$40,000	\$40,000	-	-	\$80,000
7.2	-	\$40,000	\$40,000	-	-	\$80,000
8	\$50,000	\$70,000	\$110,000	\$110,000	\$120,000	\$450,000
Total	\$531,000	\$671,500	\$565,500	\$110,000	\$120,000	\$1,998,000

TOTAL BUDGET ESTIMATE  
FIVE YEARS WITH PRIORITY

Development of Technology for Industrial Production and Utilization of Food and Feed  
Proteins by Microbial Means, Including Research Into Different Aspects of Toxicity  
and Biological Value

Task Number	Type of Task	Starting Date	Duration of Task	First Priority Estimated Budget (\$)	Second Priority Estimated Budget (\$)	Third Priority Estimated Budget (\$)
1	Clerical	July, 1974	5 Years	\$500	\$2000	\$2000
2A	Conference	July, 1974	3 Days	\$5000	\$9000	\$9000
2B	Conference	Sept., 1974	3 Days	--	\$9000	\$9000
3.2	Conference	Sept., 1974	1 Day	\$1000	\$1000	\$1000
4.1	Res. & Dev.	July, 1974	2 to 3 Years	\$50,000	\$110,000	\$250,000
4.2	Res. & Dev.	July, 1974	2 to 3 Years	\$50,000	\$110,000	\$250,000
4.3	Conference	Sept., 1975	1 Week	--	\$2000	\$2000
5.1	Res. & Dev.	July, 1974	2 to 3 Years	\$30,000	\$80,000	\$160,000
5.2	Res. & Dev.	July, 1974	2 to 3 Years	\$30,000	\$80,000	\$120,000
6.1	Res. & Dev.	July, 1974	2 to 4 Years	\$50,000	\$100,000	\$250,000
6.2	Res. & Dev.	July, 1974	2 to 3 Years	--	\$80,000	\$100,000
6.3	Res. & Dev.	July, 1974	2 to 3 Years	--	\$100,000	\$200,000
6.4	Workshop	Sept., 1974	2 Months	--	\$20,000	\$35,000
7.1	Res. & Dev.	July, 1975	2 to 3 Years	--	\$80,000	\$80,000
7.2	Res. & Dev.	July, 1975	2 to 3 Years	--	\$80,000	\$80,000
8	Res. & Dev.	July, 1974	3 to 5 Years	\$40,000	\$150,000	\$450,000

TOTAL FOR FIVE YEARS

\$256,500    \$1,013,000    \$1,998,000  
(1st Priority) (2nd Priority) (3rd Priority)

WORKING PROGRAM

Project No. 2

PROJECT TITLE:

Engineering Research and Development of Equipment and Methods for the Computerized Simulation, Design and Control of Processes for Microbial Technology

PROJECT COORDINATORS:

Dr. Shamil Yenikeyev, Kazan Institute Chemical Technology  
Dr. Arthur Humphrey, University of Pennsylvania

SK NUMBER	NAME OF TASK OR SUB-TASK	NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS	DATE AND DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
1	Development of techniques and new sensors for measuring the significant variables in microbial processes and assembling equipment for experimental investigations.				
2	Conference and position paper on needed instrumentation	Yenikeyev Kazan Inst. Chem. Tech.	one week summer 1974	conference at Univ. of Penna. 5 USSR part. 5 US part.	position paper on needed instru- mentation
3	Development of Instrumentation relative to measurement of biomass (including computer interface & software)	Humphrey Univ. of Penna.	two years 1974-1976	exchange of research reports two man years	equipment development
1.4	Development of Instrumentation relative to measurement of system dispersion (including interface & software)	Yenikeyev Kazan Inst. Chem. Tech.	two years 1974-1976	exchange of research reports	equipment & theory development

WORKING PROGRAM

Project No. 2

PROJECT TITLE:

Engineering Research and Development of Equipment and Methods for the Computerized Simulation, Design and Control of Processes for Microbial Technology

PROJECT COORDINATORS:

Dr. Shamil Yenikev, Kazan Institute Chemical Technology  
Dr. Arthur Humphrey, University of Pennsylvania

NAME OF TASK OR SUB-TASK	NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS	DATE AND DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
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Investigation of momentum, heat, and mass transfer in heterogeneous gas-liquid-liquid type of culture condition

1	Conference on mechanisms of hydrocarbon uptake by micro-organism	? Inst. Protein Synth. USSR	Erickson Kansas State Univ.	one week fall 1974	conference at Inst. Prot. Synth. Moscow, USSR 5 USSR part. 5 US part.	Report on status & the HC uptake by micro-organisms
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2	Development of hydro-dynamical theory for heterogeneous gas-liquid-liquid microbial culture	_____	Erickson Kansas State Univ.	two years 1974-1976	exchange of research reports	theory development
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3	Development of experimental apparatus and taking of data for creation of a hydro-dynamical model of the heterogeneous gas-liquid-liquid fermentation system	Yenikev Kazan Inst. Chem. Tech.	_____	two years 1974-1976	exchange of research results	equipment development
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# WORKING PROGRAM

Project No. 2

## PROJECT TITLE:

Engineering Research and Development of Equipment and Methods for the Computerized Simulation, Design and Control of Processes for Microbial Technology

## PROJECT COORDINATORS:

Dr. Shamil Yenikayev, Kazan Institute Chemical Technology  
Dr. Arthur Humphrey, University of Pennsylvania

NUMBER	NAME OF TASK OR SUB-TASK	NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS	DATE AND DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
	Research on microbial population dynamics of heterogeneous systems				
1	Development of a kinetic theory for behavior of microbes in a heterogeneous system	Erickson Kansas State Univ.	two years 1974-1976	exchange of research reports	model development
2	Development of experimental apparatus and taking of data for creation of a model for microbial population behavior in a heterogeneous system	Yenikayev Kazan Inst. Chem. Tech.	two years 1974-1976	exchange of research reports	creation of a model for computer control appl
3	Conference to integrate results of tasks 1, 2 and 3 and to assist in the design of the experimental demonstration unit (at Inst. Protein Synth.)	? Inst. Prot. Synthesis Yenikayev Kazan Inst. Chem. Tech.	one month summer 1976	working conf. on equip. design	equipment design & specification

# WORKING PROGRAM

Project No. 2

## PROJECT TITLE:

Engineering Research and Development of Equipment and Methods for the Computerized Simulation, Design and Control of Processes for Microbial Technology

## PROJECT COORDINATORS:

Dr. Shamil Yenikev, Kazan Institute Chemical Technology  
Dr. Arthur Humphrey, University of Pennsylvania

TASK NUMBER	NAME OF TASK OR SUB-TASK	NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS		DATE AND DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
		U.S.S.R.	U.S.			

Development of Engineering techniques for optimal design of industrial scale fermentor and automatic control of industrial fermentation processes

Exchange visits in order to coordinate the plans for the computer coupled fermentation control systems

Yenikev  
Kazan Inst.  
Chem. Tech.

Humphrey  
Univ. of Penna.  
Cooney-Mass. Inst. Tech.  
Jefferys  
Widener College

two men (each side) exchange visits one at post-doctoral level for one year, one at faculty level for three months

exchange visits

information exchange

Investigation on both the theoretical and practical aspects of computer control of fermentation systems

Yenikev  
Kazan Inst.  
Chem. Tech.

Cooney-Mass. Inst. Tech.  
Humphrey  
Univ. of Penna.

1974-1976 two men years of results M.I.T. one man year U. of P.

exchange of results and experience

knowledge in computer control systems plus software development



WORKING PROGRAM

Project No.2

PROJECT TITLE:

Engineering Research and Development of Equipment and Methods for the Computerized Simulation, Design and Control of Processes for Microbial Technology

PROJECT COORDINATORS:

Dr. Shamil Yenikev, Kazan Institute Chemical Technology  
Dr. Arthur Humphrey, University of Pennsylvania

TASK NUMBER	NAME OF TASK OR SUB-TASK	NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS	DATE AND DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
3	Investigation of both the theoretical and practical aspects of computer control of fermentation systems	Yenikev-Kazan Inst. Chem.Tech.	Coony-M.I.T. 1974-1976 Humphrey-U. of Penn. M.I.T.	exchange of results and experience	knowledge in computer control systems plus software development
1	Design and demonstration of practical system for computer control of the production of single cell protein from hydrocarbon substrates				
1	Conference to coordinate total design information	Yenikev-Kazan Inst. Chem.Tech. ? Inst.Protein Synth.	Humphrey-U. of P. Erickson-Kansas State U. Cooney-M.I.T. Jefferis-Widener Univ.	conference with key people in attendance approx.5 from each side	specificity of final design & trials runs
2	Design and Construction of the computer controlled fermentation unit	Inst. Protein Synth. ?	----- one year 1976-1977	Consultation on design and construction	optimally designed practical computer controlled fermentor

WORKING PROGRAM

Project No.2

PROJECT TITLE:

Engineering Research and Development of Equipment and Methods for the Computerized Simulation, Design and Control of Processes for Microbial Technology

PROJECT COORDINATORS:

Dr. Shamil Yenikev, Kazan Institute Chemical Technology  
Dr. Arthur Humphrey, University of Pennsylvania

TASK NUMBER	NAME OF TASK OR SUB-TASK	NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS	DATE AND DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
5.	Demonstration of optimal control of SCP fermentation through use of computer	? at appropriate site in USSR	Summer 1978	Consultations	optimal SCP process
6	JOINT WRITING AND PUBLISHING OF BOOK ON	COMPUTER SIMULATION, DESIGN & CONTROL OF FERMENTATION SYSTEMS			
6.1	Meetings to plan & outline joint book	Yenikev- Kazan Inst.Chem. Tech.	Summer 1974	Planning of joint book	Book outline & chapter assignments
6.2	Writing of individual Chapters	Yenikev- Kazan Inst.Chem. Inst.	1974-1976	Exchange and criticism of Chapters	Book manuscript
6.3	Editing and Publishing of Book	Yenikev- Kazan Inst.Chem. Inst.	1976	Editing book in both Russian and English	Jointly Published Book

## TOTAL BUDGET ESTIMATE

FIVE YEAR PLANNING FOR  
PROJECT NO. 2

"Engineering Research and Development of Equipment and Methods for the Computerized Simulation, Design and Control of Processes for Microbial Technology"

Project Coordinators: Dr. Shamil Yenikeyev  
Dr. Arthur E. Humphrey

<u>Task No.</u>	<u>Type of Task</u>	<u>Starting Date</u>	<u>Duration</u>	<u>1st</u> <u>Priority</u>	<u>2nd</u> <u>Priority</u>	<u>3rd</u> <u>Priority</u>
1.1	Conference	July 1974	1 week	10,000		
1.2	Research	July 1974	2 yrs.	130,000		
1.3	Research	July 1974	2 yrs.			
1.4	Research	July 1974	2 yrs.	USSR		
2.1	Conference	Sept. 1974	1 week	5,000		
2.2	Research	Jan. 1974	2 yrs.		65,000	
2.3	Research	Jan. 1974	2 yrs.	USSR		
3.1	Research	Jan. 1974	2 yrs.		65,000	
3.2	Research	Jan. 1974	2 yrs.	USSR		
3.3	Conference	July 1976	1 mo.	10,000		
4.1	2 Exchange Visits	1975-1976	1 yr.		24,000	
4.2	Research	July 1974	2 yrs.	180,000		180,000
4.3	Research	July 1974	2 yrs.		180,000	180,000
5.1	Conference	Fall 1976	2 weeks	10,000		
5.2	Research (consultation)	July 1976	1 yr.	USSR	5,000	
5.3	Consultation	Summer 1977	3 mos.	USSR	10,000	
6.1	Conference	Fall 1974	2 weeks			10,000
6.2	Conference & Consultation	Fall 1974	2 yrs.			50,000
6.3	Consultation & Publishing	Summer 1976	3 mos.			10,000
				345,000.	349,000.	430,000.
			CUMULATIVE TOTALS	345,000.	694,000.	1,124,000.

PROJECT NO. 3

PROJECT TITLE Genetics of Industrial Microorganisms  
Dr. J. J. Johnson and W. B. Row

WORKING PROGRAM

TASK NUMBER	NAME OF TASK OR SUB-TASK	NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS U.S.S.R. U.S.	DATE AND DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
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1. Development of genetic methods for improving industrial microorganisms  
 based on approach of molecular biology.

S.I. Altkhenin  
 Inst. Genetic and Selection  
 of Industrial Microorganisms  
 Moscow

Hallgren  
 Purdue Univ  
 Westham, Ind

1-2 days  
 1975 with both  
 ASH and GSA  
 annual meeting

conference  
 5 USSR govt.  
 5 USA govt.

design of  
 research projects

1.2. Conference to develop plans on the genetics of antibiotic producing cultures.

G.I. Gerasimov  
 Institute of New  
 Antibiotics, Moscow

A. Demina  
 M.I.T., Boston

2-3 days  
 1975

conference

design of  
 research projects

S. Mareskin  
 Institute of Antibiotics  
 Moscow

W. E. Brown  
 Squibb Co

G. B. Bradley  
 Medical College of Va.  
 Richmond

3 years  
 1975-8

exchange of  
 research  
 personnel.  
 3 man years USSR  
 3 man years USA

improved  
 production of  
 antibiotics

1.4. Development of improved methods for cell culture utilization.

L. E. Shukla  
 Moscow

M. Mandel  
 Natick, Mass.

2 years  
 1975-6

exchange of  
 scientists,  
 2 man years USA  
 2 man years USSR  
 at Post Doc level

improved  
 engineering  
 and fermentation  
 technology

WORKING PROGRAM

PROJECT NO. 3

PROJECT TITLE Genetics of Industrial Microorganisms

PROJECT COORDINATOR H.O. Halvorson and W. Brown

<u>TASK OR SUB-TASK</u>	<u>NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS</u> U.S.S.R. U.S.	<u>DATE AND DURATION OF TASK</u>	<u>FORMS OF COOPERATION</u>	<u>EXPECTED RESULTS</u>
<u>1/6</u>	<u>Genetics of non antibiotic producing cultures</u>	<u>See 1/1</u>	<u>Specifications and exchange of information</u>	<u>Coordination of research, increased yields</u>
<u>1/6 Conference</u>	<u>V. N. Knyazov</u> <u>Institute of Genetics and Selection of industrial microorganisms, Moscow</u>	<u>See 1/1</u>	<u>Participants to be selected</u>	<u>Exchange of information and approach</u>
<u>1/7</u>	<u>Use of genetic engineering and molecular biology for strain development</u>	<u>3-4 years 1975-76</u>	<u>Conference USSR in connection with an international meeting</u>	<u>Improved development of selective microbial systems for genetic engineering</u>
	<u>M. F. Shamygina</u> <u>Institute of Molecular Biology, Moscow</u>	<u>3 years 1976</u>	<u>Coordination research, exchange of information</u>	
	<u>V. I. Tanyushkin</u> <u>Institute of Biochemistry and Physiology of microorganisms, Moscow</u>			
	<u>N. I. Matvienko</u> <u>Institute of Biochemistry and Physiology of microorganisms, Novosibirsk</u>			
	<u>P. Mensink</u> <u>Brandenburgische Universität, Potsdam, Germany</u>			
	<u>R. Schellert</u> <u>Brandenburgische Universität, Potsdam, Germany</u>			

# Genetics of Industrial Nicotianism

2. Development of methods for genetic analysis for insect control.

Research project  
design, development  
exchange of  
information

I. Demand

Planning /  
Program

R. Hansen  
Univ of Wis.,  
Madison

374415  
1976-9

C. Balla

USDA Grain  
Marketing Board  
Clinton, Mississippi

Improved  
Toxin Production

PROJECT NO. 3

WEEKING PROGRAM  
PROJECT TITLE Genetics of Industrial Microorganisms  
PROJECT COORDINATOR H.O. Halderson and W. Brown

TASK NUMBER	NAME OF TASK OR SUB-TASK	NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS U.S.S.R.	DATE AND DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
3	Development of genetic methods to improve industrial strains of yeast, including utilization of hydrocarbons, methanol, etc.				
3.1	Conference on mutagenesis and recombination in yeast	<u>S.G. Ing-Vestman</u> Dept. Genetics, Leningrad Univ.	<u>R. Mortimer</u> Univ. Calif., Berkeley	conference sponsored by USA and USSR	Theory of mutagenesis as applied to strain selection
3.2	Selection of hydrocarbon utilizing yeasts	<u>S.G. Ing-Vestman</u> Dept. Genetics, Leningrad Univ.	<u>R. Mortimer</u> Univ. Calif., Berkeley	Research support postdoctoral exchange.	Improved production of hydrocarbons utilizing yeast.
3.3	Improved methods for genetic analysis in yeast.	<u>B. V. Simanov</u> Dept. Genetics, Leningrad Univ.  <u>V.I. Kozlovskii</u> Lab. Microorganisms and Breeding in yeast, Moscow.	<u>H.O. Halderson</u> Brandon V. Waltham, Mass.  <u>S. Haber</u> Brandon V. Waltham, Mass.	Research support postdoctoral exchange	Improved theory and methods for analysis and speculation.

WORKING PROGRAM  
PROJECT NO. 3  
PROJECT TITLE Genetics of Industrial Microorganisms  
PROJECT COORDINATOR H.O. Halvorsen and K. Brown

TASK NUMBER	NAME OF TASK OR SUB-TASK	NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS	DATE AND DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
4.	Development of methods of genetic analysis of microorganisms for the production of amino acids.	M.G. Dawson Inst. of Genetics and Agriculture of Indian organism, Armenia, Soviet U.S.S.R.	3 years 1974-77	cooperative technical support postdoctoral exchange	improved strains development
4.1	construction of genetic strains for amino acid production	J. Shapiro Univ. of Chicago, Chicago, Ill.			
4.2	Development of viable systems for genetic analysis in <u>Bacillus</u>	M.I. Zhdanova Stine, Moscow V.V. Subbotin Inst. Genetics and Selection of Microorganisms, Moscow H.O. Halvorsen Brandeis Univ., Waltham, Mass. F. Young Rockefeller Medical School Rockefeller, N.Y.	3 years 1974-75	joint research projects, exchange of personnel	improved genetic systems
4.3	Symposium on Genetic Methods Summary of Projects 1-4		1 week 1977	Final reports published	Publish Book on conference



EVENT	EVENT NAME	ESTIMATED COST <sup>1</sup>	PRIORITIES HOH	PRIORITIES WB
1	3rd Meeting Working Group	----	----	----
2	Conference	\$7,000	A	
3	Conference	\$6,000	A	
4	Research Projects	<i>25,000 -</i> \$75,000-\$150,000	<i>A - lowest</i> B Lower <i>middle</i> C Higher <i>+</i>	<i>w. e/s</i>
5	Research Projects	\$40,000	B	
6	Annual Conference	\$15,000	C	
7	Research Projects	\$75,000-\$150,000	A Lower C Higher	
8	Exchange Personnel	\$75,000	B	
9	Conference	\$7,000	B	
10	Research Projects	\$75,000-\$150,000	B Lower C Higher	
11	Workshop	\$7,000	A	
12	Conference	\$5,000	B	
13	Research Projects	\$75,000-\$150,000	B Lower C Higher	
14	Research Projects	\$20,000	C	
15	Conference	\$5,000	C	
16	Conference	\$5,000	B	
17	Research Projects	\$25,000-\$50,000	B	
18	Research Projects	\$50,000-\$100,000	A Lower C Higher	
19	Exchange Personnel	\$40,000	B	
20	Conference	\$4,000	C	
21	Research Projects	\$25,000-\$50,000	A Lower B Higher	
22	Research Projects	\$50,000-\$100,000	A Lower C Higher	
23	Exchange Personnel	\$40,000	B	
24	Conference	\$4,000	C	
25	Symposium	\$30,000	A	

WORKING PROGRAM

PROJECT TITLE Enzyme Applications

PROJECT COORDINATOR G.T. Tsao (U.S.A.)

I. Berezin and K. Kalunyan (U.S.S.R.)

TASK OR SUBTASK	AND COOPERATING INSTITUTIONS	DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
Search and isolation of enzyme producing strains of microorganisms of tissue cultures				
1.1 Strain selection	Moscow State Univ. N.S.F. Grantees Inst. for Protein Syn. Inst. for Chem. of Natural Prod. Tollin Poly. Inst.	5 yrs.	exchange and testing to compare strains	more productivity strains
1.2 Microbial Physiology	same	5 yrs.	joint research projects	more productivity strains
Commercial isolation and purification of enzymes				
2.1 Enzyme isolation	same	5 yrs.	joint research projects	
2.2 Process development	same	5 yrs.	joint research projects	
2.3 Stabilization of enzymes	same	5 yrs.	joint projects	
2.4 Equipment design	same	5 yrs.	joint projects	processes and equipment for enzyme production

WORKING PROGRAMS

PROJECT NO. 4

PROJECT TITLE Enzyme Applications

PROJECT COORDINATOR G.T. Tsao, I. Berezin & K.A. Kalunyante

TASK NUMBER	NAME OF TASK OR SUB-TASK	NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS	DATE AND DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
3	Immobilized Enzymes				
	3.1 Theoretical analysis and modelling	Moscow Univ. N.S.F. Grantees	5 yrs.	joint projects	development and understanding of new industrial processes
	3.2 Carrier selection	several institutions	5 yrs.	joint projects	
	3.3 Multienzyme and/or cofactor systems	same	5 yrs.	joint projects	
	Diagnostic and Analytical Uses of Immobilized Enzymes				
	4.1 Enzyme-immune essay	NSF Grantees	5 yrs.	joint projects	new diagnostic techniques
	4.2 Enzyme detection of faint light or sound	Moscow Univ. Univ. of Penn. Berrain Others	5 yrs.	joint projects	

WORKING PROGRAMS

PROJECT TITLE Enzyme Applications

PROJECT COORDINATOR G.T. Tsao, I. Berezin & K.A. Kalunyan

TASK NUMBER	NAME OF TASK OR SUB-TASK	NAME OF PARTICIPANTS AND COOPERATING INSTITUTIONS	DATE AND DURATION OF TASK	FORMS OF COOPERATION	EXPECTED RESULTS
	Technology of Enzymatic Cleavages				
5.1	Production of sugar from cellulose	L.S. Losyakova Inst. of Biosyn. of Protein Sub.	Wilke and Bassham U. Cal. Berkeley	5 yrs.	joint project
5.2	Fermentable sugars from agricultural wastes	L.S. Losyakova	Burnet and Lee	5 yrs.	joint project
5.3	Enzyme production of milk substitutes			5 yrs.	joint project
5.4	Cleavage reversal to make peptides and fine chemicals	same	Corning Glass Weetal	5 yrs.	joint project
	Participation in Polymeric 74 Conference Symposium on Production and Properties of Immobilized Enzymes				
		Berezin			Tsao

USE OF  
ENZYMES IN  
AGRICULTURE

PROJECT NO. 4 BUDGET PLAN  
FISCAL YEAR

PROJECTS	1974	1975	1976	1977	1978
(1) Polymery 74 Project 4, Task 6	\$10,000				
(2) Fermentable sugar Iowa State Project 4, Task 5.2	\$80,000	100,00	120,000	140,000	160,000
(3) Sugar from cellulose Berkeley Project 4, Task 5.1	\$80,000	100,000	120,000	140,000	160,000
(4) Acoustic Imaging Project 4, Task 4.2	\$60,000	80,000	100,000	120,000	140,000
(5) First Priority Group	\$230,000	280K	340K	400K	460K
(6) Leavage Reversal orning Glass Project 4, Task 5.4	\$90,000	100K	110K	120K	130K
(7) Project 4, Task 5.3	-----	80K	100K	120K	140K

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